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PURCHASED THROUGH
DOC. EX. PROJECT

23

84th Congress
2d Session

JOINT COMMITTEE PRINT

JOINT COMMITTEE ON ATOMIC ENERGY

UNIVERSITY
OF MICHIGAN

AUG 13 1956

MAIN
READING ROOM

INTERIM REPORT

OF THE

SUBCOMMITTEE ON RESEARCH AND DEVELOPMENT

ON THE

Shortage of Scientific and Engineering Manpower

JULY 12, 1956

Printed for the use of the Joint Committee on Atomic Energy

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1956

80481°

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SHORTAGE OF SCIENTIFIC AND ENGINEERING MANPOWER

Interim Report

INTRODUCTION

In the past decade the United States has taken enormous strides in technological development. Whole new vistas have been opened as a result of these advances and consequently the demand for skilled talent in almost all fields of endeavor is unprecedented. This has been particularly evident in the fields of science and engineering where shortages in some instances have reached the critical stage. At a time when science and technology are the key both to military superiority and to economic strength, the popular consciousness of the immediate and urgent need for men and women to man the laboratories, the drawing boards, and the production lines is essential and understandable.

It is important to recognize at the outset that these serious shortages are not a sign of failure but an indication of startling success. A way of life has been created in which the demands made for superior skills in every field have become so tremendous that growth and expansion have become constant elements of the normal pattern. A society has been created in which progress is not simply a matter of occasional spurts and short-term crises. Rapid progress has become a normal part of our national life, and the skilled manpower to keep up with this steadily and rapidly advancing march of progress will be in demand for years to come.

But these considerations should not becloud the fact that the shortage of skilled talent in this country is a very real problem and one with which we must come to grips if we are to maintain the present rate of growth which is so essential to the Nation's strength and well-being. We are, in essence, engaged in a battle for brainpower. The price of continuing progress and prosperity is an unceasing effort to develop our intellectual resources to the maximum possible extent.

A sense of added urgency has been given to the manpower problem in this country by disturbing reports that the Russians have launched a massive educational program to train scientists and engineers for use in Russia and, more ominously, for export to the uncommitted areas of the world. Few people will deny that the immediate need—vis-a-vis Russia—is indeed serious. But this is only one aspect of the total picture. The shortage of trained and educated manpower would be equally pressing without the Russian threat, although it would perhaps not be as readily recognized. To that extent the pressure created by the Soviet danger may even be beneficial.

Among the areas most vitally affected by the manpower shortage has been the field of nuclear energy which is emerging from an era of exclusively military application to one where peaceful uses are assuming an ever increasing importance. With this shift in emphasis toward peaceful applications has come a growing demand for trained technicians, a demand which can only partially be met by available sources of talent. The resulting shortage has been characterized by Commissioner Willard F. Libby of the Atomic Energy Commission as the greatest single deterrent to progress in our atomic energy program.

Impressed with the importance of developing a sound, coherent policy aimed at alleviating these shortages and providing for future needs, the Research and Development Subcommittee scheduled a series of public hearings in April, designed to determine the nature of the problem and to develop recommendations for corrective action. Five days of hearings were held during which nearly 500 pages of testimony was received from 32 witnesses, most of whom are leading experts in the fields of education, science, industry, labor, and Government.

A number of important points were developed during the hearings but two major themes kept recurring: (1) that the shortage of scientists and engineers is only part of a larger shortage of skilled manpower throughout our economy and that our interests will best be served in the long run by expanding our overall supply of trained individuals; and (2) that there has been a rapid deterioration in the quality and quantity of mathematics instruction in our high schools in recent years and that vigorous action is imperative to restore this important subject to its rightful place as a fundamental part of the curriculum, and as an indispensable element in preparation for college level studies in science and engineering. As a means of improving the quality of mathematics teaching and of arousing interest among students and their parents in improved mathematics courses, the committee believes that special consideration should be given to the recommendation by Prof. I. I. Rabi of Columbia University for the establishment of a Federal mathematics scholarship award program. (See major recommendations.)

THE NATURE OF THE PROBLEM

It is almost universally conceded that there is a critical shortage of technically trained manpower in this country. But the nature of the crisis is not generally understood and the remedies frequently suggested tend to deal with the superficial and immediate problems rather than the more basic causes of the shortage. In this respect they threaten, in the long run, to create more serious crises.

The fundamental problem is not that the United States lacks manpower in one limited, clearly separable area. Yet, because the manpower shortage is too often treated for its symptoms rather than for its organic causes, the current fasion is to tackle it either piecemeal or by short-range, shock treatment.

This is understandable. The country is—and needs to be—in a position of alert. The United States considers itself as opposed ideologically, and possibly militarily, by a powerful combination of Soviet-bloc nations. The United States, moreover, is aware that it

is the core and rallying point of the free nations and the people of this country are conscious of the pressing need for more technical manpower to maintain our military and economic strength.

Modern defense is total. It cannot be achieved in the medieval manner of putting up a few strong, scattered forts. It demands strength throughout the entire fabric of national life. It requires the kind of cohesion and total national well-being that no military or peacefully competitive contest of the past has ever demanded.

The important new fact of national life is that the shortages of educated, skilled brainpower extend to all areas—from the drawing boards to distribution; from engineering to management; from the laboratory to the classroom. There is an unprecedented demand for more skilled, educated brains. The demand will increase for many years to come. Therefore, the shortage will become more critical.

But it would be tragic if—as the committee was warned—the United States is stampeded into short-sighted action. The committee was reminded of widespread forecasts made shortly after World War II which predicted an oversupply of engineers and, at least by implication, encouraged high school guidance counselors to steer young people into other vocational channels. These estimates were not inaccurate—at the particular time and based only on the immediate, short-range picture. But they were tragically wrong in terms of the future.

The point, therefore, is that the critical shortages of manpower should be considered a total shortage of trained individuals in every field, and that in our efforts to remedy short-term deficiences we should be careful not to create imbalances which will threaten our overall strength in the long run.

MAJOR RECOMMENDATIONS

During the course of its hearings the committee was impressed with the many excellent recommendations for remedial action. These deserve the most careful study and the committee hopes that a thorough analysis of them will be made in the next Congress with a view to developing a concrete program of action.

The principal requirements are (*a*) a stronger program for identifying the ablest students in our high schools at an early age and presenting them with challenging courses to stimulate their minds; (*b*) greater encouragement of students with high ability to continue their education beyond high school and removal of economic barriers; (*c*) taking all necessary steps to improve the supply of high-quality teachers at the high school and college level; (*d*) better utilization of talent presently available in industry, the Armed Forces, and education; (*e*) broadening in-service training and conversion of available talent in industry, in cooperation with educational institutions and others.

Listed below are a few of the major recommendations made to the committee that illustrate the types of approach which might assist in meeting these requirements:

(1) *Establishment of a Federal mathematics scholarship award program* to provide a substantial cash award to any high school graduate who passes an examination, at college entrance level, in mathematics. The examination would be open to all and there would be no compulsion to pursue studies in science. Chief objective of the award would

be to arouse greater interest in high school mathematics as an important part of general education and an indispensable base for college-level study in science and engineering. For those who go on to college another cash award would be provided at the end of freshman year upon successful completion of a course in calculus.

(2) *Earlier identification of potentially ablest students.*—At present only 4 out of 5 students in the top quarter of their class finish high school. Only 2 out of 5 in the top quarter go on to college. Many with high potential simply do not enroll in college preparatory programs. In order to recoup this loss of potential talent it is proposed that statewide testing start at the 8th or 9th grade level rather than the 12th. This would help insure that the ablest students don't drop out of school and that they take the kind of courses necessary for college entrance. Increased emphasis should also be placed on intellectual rigor for the ablest students and challenging programs provided.

(3) *Increased pay for high school teachers and greater flexibility in salary scales.*—There was virtually unanimous agreement that substantial increases must be made in the pay of high school teachers if we are to attract and maintain the type of qualified people we need. This is particularly true in the case of science and mathematics teachers who are being offered up to double their school salaries by private industry. In terms of actual purchasing power, the average salary of high school teachers is no greater today than it was in 1904. Also needed is abolishment of rigid salary scales which do not differentiate between the most able teachers and the less able. The present system acts as a source of discouragement to talented young teachers entering the profession and encourages mediocrity. In addition, encouragement should be given to expansion of summer institutes, such as those being conducted by the National Science Foundation, to provide refresher courses for high school mathematics and science teachers.

(4) *Federal contribution to private scholarship foundations.*—Federal funds could be used to supplement scholarships offered by private organizations such as National Merit Scholarship Foundation which provides 500 four-year college scholarships annually on the basis of a general nationwide competitive examination. Main advantage of the plan is that foundations are already going concerns and minimum time would be lost in putting Federal funds to work. It is interesting to note in this connection that nearly two-thirds of the boys selected for the national merit scholarships this spring indicated a career choice of engineering or scientific research. Consideration should also be given to supplementing teaching fellowships.

(5) *Establishment of a national educational reserve.*—To help alleviate the shortage of qualified mathematics and science teachers in our high schools it is proposed that a national educational reserve be set up comprising qualified teachers of mathematics, physics, chemistry, engineering, and related subjects, to be drawn from the ranks of private industry. Under this plan industry would release with full pay for at least a year a reasonable number of men and women for teaching assignments in nearby high schools, particularly in the upper grades. The reserve could also mobilize qualified persons of retirement age for part-time teaching and draw on qualified people willing to teach in night schools without taking leave from their industry jobs.

(6) *Better utilization in private industry.*—Industry should be encouraged to abolish the system of hiring excess numbers of our top young science and engineering graduates when there are actually no job openings. This practice is employed to ensure future availability in case of need but is wasteful of scarce talent and self-defeating in the long run because of the large turnovers which result. Greater efforts should also be made within industry to see that the full talents of scientists and engineers are being exploited and that routine work is left to less skilled personnel. In addition, on-the-job training and night courses for employees in science and engineering should receive greater emphasis.

(7) *Better utilization in the armed services.*—Despite improvement in utilization of scientists under the Armed Forces' scientific and professional personnel program (SPP), there are still some 5,000 or more specialists in the service who are "lost" in the enlisted ranks doing routine chores such as KP duty. Vigorous efforts should be made to locate these highly skilled men and action taken toward either assigning them duties and responsibilities commensurate with their scientific talents, or providing for their early release from the compulsory 2-year tour of duty. Considerable improvement can also be made in the ROTC program. At present, little attempt is made to assign young officers with scientific and engineering backgrounds to duties for which they have been prepared. The compulsory 2-year tour of duty for officers with these skills is largely wasted time and often results in failure of the exceptional student in the ROTC to continue his studies for an advanced degree. Perhaps the setting up of a separate scientific corps within the armed services would help insure more intelligent utilization, both in enlisted and officer ranks. Or consideration might be given to creation of a scientific personnel board with review power over both Selective Service and over use of scientists in the service.

(8) *Aid to universities in training technical assistance representatives.*—In view of the vital worldwide competition of the Communist philosophy for the minds and loyalties of the millions in the uncommitted and underdeveloped areas of the world, it is suggested that the Government contribute funds to existing colleges and universities to help train United States technical assistance representatives for service abroad.

(9) *Marshaling free world's scientific resources.*—Inasmuch as we are seriously outnumbered in population by the Russians, cooperation of the free world countries is proposed to marshal scientific resources and to develop common programs. Such cooperative programs might include scholarships and fellowships, equipment and libraries, summer institutes, and visiting professors. Cooperation with underdeveloped countries would be emphasized. Some organization such as NATO in Europe or SEATO in the Pacific might be utilized as the coordinating body.

(10) *Atomic energy: Expansion of reactor training programs.*—The estimated need for reactor technicians is 2,000 for each of the next 3 years. We are at present producing only 500 per year. Moreover, within the next 15 to 20 years there is expected to be some fifty to sixty million kilowatts of electric generating capacity in nuclear powerplants, with a resulting large increase in demand for reactor technicians. It is therefore recommended that all possible steps be taken to increase the number of such technicians, including:

1. Expansion of the Government's reactor training programs;
2. increasing the number of "reactor kits" containing subcritical assemblies to be made available to universities for instruction in reactor technology; and
3. providing aid and assistance to universities in the construction and operation of research reactors.

Provisions incorporating the recommendations in this section are contained in proposed legislation recently reported out to the Congress by the Joint Committee.

CONCLUSION

All recommendations and conclusions lead back to the basic fact that there is no single or final solution to the shortage of skilled manpower and that the efforts of all, Government and private, will be required if we are to make progress. As the shortage of scientific and engineering manpower is only part of a larger national problem involving the need for competent trained people in all fields of endeavor, our main objective should be the development of all our intellectual resources.

The greatest need at the present time is for a vigorous and coherent national policy to provide guidance for all participants, Government and private, in a coordinated program of remedial action. In framing such a program it is important to bear in mind that present shortages of manpower in this country are a symbol of success, not of failure; that inherent in our constant growth and expansion are increasing demands for skilled persons of all kinds—demands which may never be completely met. This is not a crisis to be deplored. It is an unprecedented achievement and eloquent testimony to the success of a social experiment which, when this Republic was founded, was only a dream and an ideal.

Now that so much of the dream has come true, the continued approach to the ideal can only be maintained by the full development and the wise use of all the brainpower of all the men and women who are part of the experiment. This alone is the problem of the future.

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